



BANK OF CANADA
BANQUE DU CANADA

Discussion Paper/Document d'analyse
2014-4

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by Nicholas Labelle and Varya Taylor

Bank of Canada Discussion Paper 2014-4

July 2014

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No responsibility for them should be attributed to the Bank of Canada.

Acknowledgements

We would like to thank Paul Miller, Pierre Roach, Harry Ivey, Carol Ann Northcott, Ryan Huggett, Lana Embree, Nikil Chande, Sophie Lefebvre, Christian Bélisle, Nancy Goundry, Tom Hossfeld, Miguel Molico and Darcey McVanel for helpful comments and suggestions. We are also grateful to Joey Murray and Gabriel Xerri for providing the data and figures for this work. All remaining errors are our own.

Abstract

A default in the Automated Clearing Settlement System (ACSS) occurs when a Direct Clearer is unable to settle its final obligation. In August 2012, the Canadian Payments Association amended the ACSS by-law and rules to repeal the unwinding provisions from the ACSS default framework. Without unwinding, payment items are no longer returned by the defaulter to the other participants as a means of reducing the defaulter's final obligation. Instead, the other Direct Clearers (survivors) pay only additional settlement obligations to cover the defaulter's shortfall. To assess the potential exposures of an ACSS default without unwinding, we use simulations to estimate the value of additional settlement obligations for each survivor and compare these exposures to their capital and liquid assets. Results indicate that these exposures are indeed manageable by survivors and, therefore, that the ACSS does not pose systemic risk.

JEL classification: C, C15, G, G01, G2, G3

Bank classification: Payment clearing and settlement systems; Financial stability

Résumé

Lorsqu'un adhérent au Système automatisé de compensation et de règlement (SACR) est dans l'incapacité de régler son obligation finale, il se trouve en situation de défaillance. En août 2012, l'Association canadienne des paiements a modifié les règles et les règlements relatifs au SACR dans le but d'abroger les dispositions de déboucement encadrant les défaillances du système. En absence de déboucement, le défaillant ne renvoie plus les effets de paiement aux autres adhérents pour réduire son obligation finale. Au lieu de cela, les autres adhérents (ou les survivants) s'acquittent simplement d'une obligation supplémentaire de règlement pour couvrir le déficit du défaillant. Pour évaluer les expositions potentielles à la défaillance d'un adhérent au SACR en absence de déboucement, les auteurs estiment par des simulations la valeur des obligations supplémentaires de règlement de l'ensemble des survivants et comparent ces expositions à leurs fonds propres et actifs liquides. Les résultats de l'étude indiquent que les survivants sont en mesure de gérer ces expositions et, par conséquent, que le SACR ne présente aucun risque systémique.

Classification JEL : C, C15, G, G01, G2, G3

Classification de la Banque : Systèmes de compensation et de règlement des paiements; Stabilité financière

1 Introduction

Payment clearing and settlement systems are the backbone of the financial system. Their malfunctioning could rapidly affect many important economic activities. In Canada, most retail payments are cleared and settled through the Automated Clearing Settlement System (ACSS), which is owned and operated by the Canadian Payments Association (CPA). Retail payments cleared through the ACSS include cheques, debit card payments and other electronic payments. In 2012, 30.5 per cent of the total retail payment volume and 76.2 per cent of the total retail payment value in Canada were cleared through the ACSS.¹

The Bank of Canada (BoC) has not designated the ACSS under the Payment Clearing and Settlement Act (PCSA), because it does not pose systemic risk as defined by the Act.² However, the BoC monitors and conducts research on payment and securities settlement systems to evaluate their potential for systemic risk implications.

On 17 August 2012, amendments to CPA By-law No. 3 – *Payment Items and Automated Clearing Settlement System* repealed the unwinding provisions from the ACSS default framework. Prior to the amendments, a participant in default had to immediately return payment items for which it owed funds, and the surviving participants had to return items payable by the defaulter. The unwinding provisions were the key risk mitigation tool in the ACSS and were meant to improve the financial position of the participant in default. In 2009, the CPA undertook a review of its default framework and concluded that unwinding provisions were no longer an efficient risk management tool and could lead to operational challenges and uncertain financial impacts (Canada Gazette 2012).

In light of the removal of the unwinding provisions, we use simulations to assess the credit and liquidity risk implications for direct clearers in the ACSS. In this paper, we provide background information on the ACSS default framework, a summary of previous research and some statistics. We then discuss the methodology and results of the simulations. The paper concludes with suggestions for additional measures that the CPA could pursue to mitigate risks in the ACSS.

2 Background on the ACSS Default Framework

Transactions cleared and settled by the ACSS include debit card payments, automated teller machine (ATM) transactions, cheques, direct debits (e.g., pre-authorized debits and point-of-sale (POS) debits) and credit transfers, such as bill payments and direct deposits (see CPA website). Clearing is defined by the reconciliation of payment items that were

¹ These numbers are based on CPA statistics and estimates; they include cash, CPA payments and non-CPA payments. Non-CPA payments include credit card, prepaid card and “on-us” payments (payments processed internally by a financial institution).

² The PCSA defines systemic risk as the risk that the inability of a participant to meet its obligations in a clearing and settlement system when due could cause other participants, financial institutions and clearing houses to fail on their own obligations when due. For a description of the BoC’s oversight framework and practices, see Bank of Canada (2012a).

exchanged and the calculation of clearing balances.³ Settlement is the transfer of payment used to extinguish the obligation, which is based on the final multilateral net position (MNP) of each direct participant.

There are 11 direct clearers (DCs) in the ACSS, in addition to the BoC. Each DC makes entries in their ACSS terminal for the delivery and receipt of payment items, which are categorized by payment stream. DCs can act as clearing agents (CAs) for indirect clearers (ICs) and make ACSS entries on their behalf.⁴

The ACSS is a “debit pull” system whereby the DC that is owed funds enters the data in the ACSS. The cut-off time to make ACSS entries varies by the type of payment exchanged, but the final closing time is 23:00 Eastern Time (ET). At 11:00 ET on the next business day, the ACSS calculates each participant’s final MNP. Final settlement occurs across the books of the BoC. (Note that all ACSS DCs must have a settlement account at the BoC and all DCs are currently direct participants in the Large Value Transfer System (LVTS).) To transfer funds, DCs with a negative MNP must send a payment to the BoC using the LVTS to cover their position owing plus interest. Once all negative positions are funded, the BoC sends LVTS payments to those DCs that are owed funds. Similarly, ICs settle their positions with their CA using the accounts they have with them.

The legal framework for a default of a DC is set out in By-law No. 3 – *Payment Items and ACSS*, Rule L1 – *Procedures Pertaining to the Default of a Direct Clearer*. A default is described as a situation where, after any advances have been made by the BoC, a shortfall remains in the settlement account of a DC that precludes settlement. Thus, a DC would be in default if it fails to submit an LVTS payment or, in the case when the LVTS is not available, secure a fully collateralized intraday loan from the BoC.⁵

The framework for unwinding payments was in place since 1994 and the objectives were to reduce the remaining settlement balance of the defaulter and ensure that the system settles. The unwinding provisions refer to the process whereby the defaulting DC returns payment items for which it owes funds and surviving DCs return payment items payable by the defaulter, thereby improving the financial position of the defaulter.⁶ Items returned by the surviving DCs included Electronic Data Interchange (EDI) credits and online payment items received from the defaulting DC, as well as Automated Funds Transfer (AFT) credits and paper credit items delivered by the defaulting DC. Items returned by the defaulting DC included AFT debits and paper debit items (such as cheques) delivered

³ For a description of ACSS and associated risks, see CPA (2005; 2012).

⁴ Clearing agents also include group clearers. Group clearers exchange payment items and make ACSS payment entries on behalf of themselves and entities belonging to a group.

⁵ Since November 2003, ACSS settles through LVTS in Tranche 1 (Tuer 2003). The LVTS consists of two payment streams: Tranche 1 and Tranche 2. The Tranche 1 credit limit is fully secured by collateral pledged by the sending participant. The Tranche 2 credit limit is partially collateralized by each participant and depends on both bilateral and multilateral credit limits, i.e., on credit limits that participants extend to each other. For more details, see Arjani and McVane (2006).

⁶ Different procedures exist for the default of a DC and an IC. For the remainder of the paper, we focus on the default of a DC.

to the defaulting DC. Point-of-sale (POS) items, including Interac debit card transactions, are irrevocable under ACSS rules and would not be unwound.

If a shortfall remained after the unwinding, the surviving DCs would have shared losses in proportion to the value of items they entered against the defaulter. The share of the shortfall that a survivor owes is called an additional contribution (AC).

Northcott (2002) examined the risks associated with the unwinding provisions in the ACSS. Using data from August 2000 to June 2001, the author concluded that the ACSS can pose systemic risk only under extreme conditions. Although the operational and legal hurdles associated with unwinding were not examined in detail, the author found that its effectiveness as a risk mitigation tool depended greatly on how much funds survivors can recover from the customer accounts they have credited (see Northcott 2002, 29–32). For instance, when cheques or electronic payments are exchanged, the payee bank credits the account of the customer depositing the cheque or receiving the payment. But the payer bank of the customer who wrote the cheque or sent the payment still has to settle for the funds. If the payer bank fails to meet its ACSS obligation at settlement, the payee bank could try to recover the funds from the customer who deposited the cheque or received the payment. If little can be recovered from customer accounts, high levels of unwinding would lead to greater credit and liquidity risks for surviving participants.⁷ For various reasons, including more electronic payments and the potential negative impact on customer relations, the rates of funds recovery will likely be low.

Northcott (2002) demonstrated that under low rates of funds recovery, higher levels of unwinding also led to greater contagion through knock-on defaults. Under an extreme scenario,⁸ there were no knock-on defaults with no unwinding, compared with one knock-on default for a 50 per cent level of unwinding and two for a 75 per cent level of unwinding. Finally, Northcott (2002) stressed the importance for the system operator to set rules that would minimize the potential for contagion for two reasons: the defaulter controls the level of unwinding by controlling which payments are returned, and the effectiveness of unwinding depends on how much value survivors can recover from their customers' accounts.

The removal of the unwinding provisions in August 2012 was motivated mainly by the uncertainty it generated:

- Unwinding is more easily applied to paper items than electronic items. However, electronic items have grown considerably over the past 10 years and today's systems cannot necessarily unwind these electronic payments.
- Members provide clients with faster access to funds, which makes it more difficult to reverse these transactions and recoup the funds. Doing so might also

⁷ Northcott (2002) measured credit risk relative to Tier 1 capital as reported to the Office of the Superintendent of Financial Institutions (OSFI). Liquidity risk was measured relative to a portfolio of liquid assets comprising cash deposits and securities issued or backed by the Government of Canada.

⁸ The extreme scenario assumes that survivors have 10 per cent of Tier 1 capital and 10 per cent of liquid assets; all items are returned to survivors; nothing can be recovered from customers; and there is a 75 per cent rate of recovery from the estate of the defaulting institution.

lead to insufficient funding for payments drawn on a client's account, such as utility bills and mortgage payments.

- If the defaulter goes into receivership, the receiver would have no legal obligation to follow CPA rules.

Not only is unwinding operationally difficult, it provides no certainty as to which items would be unwound since the defaulter has some discretion. Moreover, the defaulter's MNP can become a surplus if the value of returned items is greater than the defaulter's original MNP. This could lead to legal challenges for the survivors to recoup this surplus.

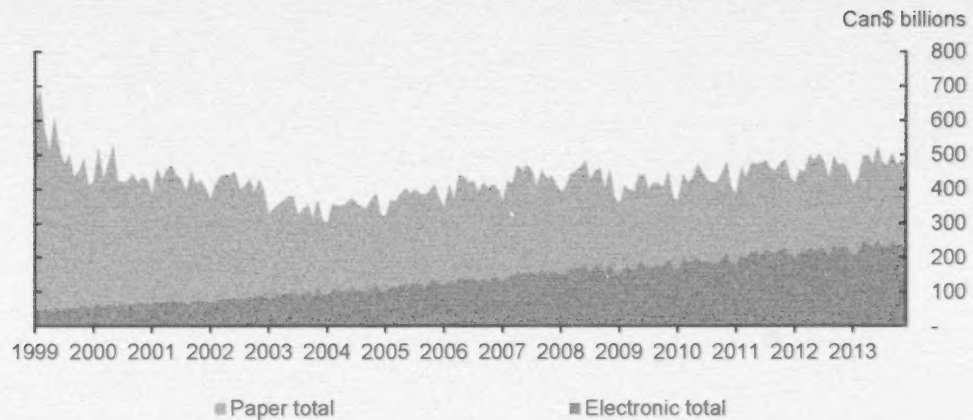
With the removal of the unwinding provisions, the shortfall is now directly allocated to the surviving DCs in proportion to the value of items they entered that are payable by the defaulter. This loss allocation simplifies default management and removes the operational and legal challenges associated with unwinding.

3 ACSS Statistics

This section presents some ACSS statistics to provide perspective on the simulation results presented later in the paper. From 2007 to 2013, there was an average of 24.2 million items cleared daily through the ACSS and an average daily value of \$21.5 billion. On average, the five largest banks – Royal Bank of Canada (RBC), Toronto-Dominion Bank (TD), Bank of Montreal (BMO), Canadian Imperial Bank of Commerce (CIBC) and Bank of Nova Scotia (Scotiabank) – enter about 80 per cent of the total value in the ACSS.

Electronic payments represent an increasing share of the value and volume in the ACSS (Figure 1 and Figure 2) and now represent the majority of items cleared through the ACSS. Further migration of payments occurred in 2003 with the introduction of the \$25 million cap on all paper items cleared through the ACSS. It should also be noted that in 1999, ACSS values declined because of the migration of large payments to the LVTS following the launch of LVTS in February 1999.

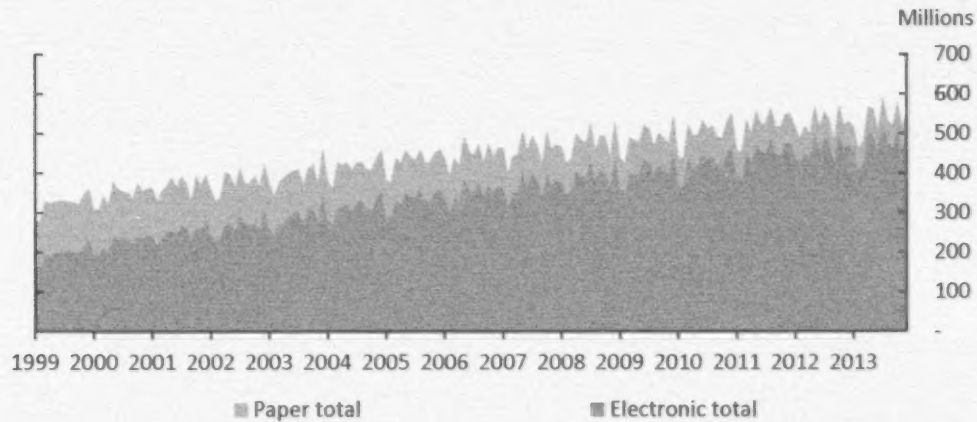
Figure 1: Electronic and Paper Transaction Values in ACSS (monthly)



Source: CPA

Last observation: 31 December 2013

Figure 2: Electronic and Paper Transaction Volumes in ACSS (monthly)

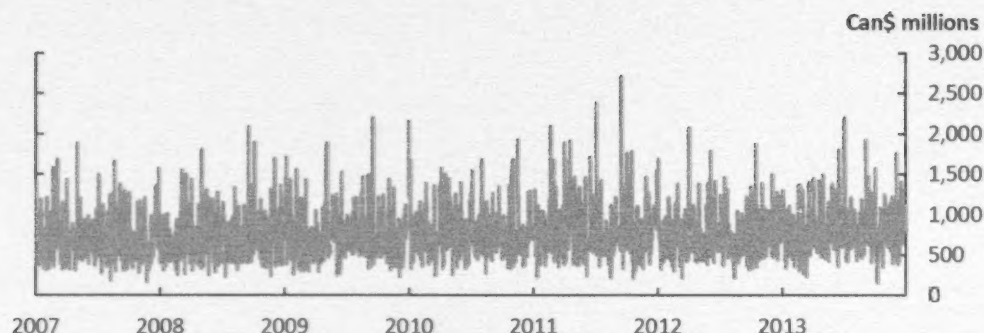


Source: CPA

Last observation: 31 December 2013

Total pay-ins and payouts refer to the settlement obligations due by or to the DCs (i.e., the sum of the absolute value of MNPs). From January 2007 to December 2013, the average daily total pay-in was \$750 million, with a minimum of \$155 million and a maximum of \$2.7 billion (Figure 3).

Figure 3: Total Pay-in/Payout Values (daily)



Source: CPA

Last observation: 31 December 2013

4 Default Scenarios

The rest of the paper focuses on the credit and liquidity risk exposure that surviving DCs would face in the event of a default of a DC in the ACSS *without* unwinding.

A default in the ACSS implies that a DC cannot make an LVTS payment to settle its ACSS obligation or does not have sufficient eligible collateral to apply for an intraday loan from the BoC.⁹ In reality, an unanticipated default in the ACSS is unlikely given the supervisory framework for financial institutions, which includes monitoring, early intervention and coordination among regulators. It is also likely that the BoC would notice persistent liquidity problems before a default would occur, especially if the participant frequently needs advances from the BoC to settle its LVTS balance. (Recall that DCs in the ACSS are also direct participants in the LVTS.)

Nonetheless, if a DC cannot settle its negative MNP in the ACSS, the BoC will notify the CPA President, who then informs the other DCs. The surviving DCs will have to cover the defaulter's shortfall and pay an AC payable at time t for payment items exchanged on $t - 1$.¹⁰

⁹ This analysis is limited to the ACSS and does not consider interactions with other systems, such as the LVTS. If a DC were to default in the ACSS intraday, however, it would not likely be able to settle its final payment obligation in the LVTS (assuming that it has a negative position in the LVTS) unless the Bank provides Emergency Lending Assistance (ELA). ELA can be provided so long as the DC is solvent and can fully collateralize the loan according to the Bank's provisions (Bank of Canada 2012b). (The Bank is willing to accept a broader range of collateral for ELA.) Similarly, a default in the LVTS would likely imply a default in the ACSS the next day.

¹⁰ Section 57 of CPA By-law No. 3 specifies that the surviving DCs have to deposit the ACs in the defaulter's settlement account upon receiving a notice from the BoC. Once in the defaulter's settlement account at the BoC, the amount and the interest immediately become a debt that is due and payable by the defaulter to the surviving DCs. The interest rate is the Bank rate minus 0.25 per cent. See ACSS Rule J10 section 10 for more details.

$$AC_t = \text{Shortfall}_t^* \frac{\text{Value of Payment Items Entered by DC Drawn on or Payable by Defaulter}_{t-1}}{\text{Total Value of Payment Items Entered by All DCs Drawn on or Payable by Defaulter}_{t-1}}$$

5 Simulation Results

5.1 Simulation of ACs

The impact of a default without unwinding is analyzed using historical data. ACs are calculated from 2 January 2007 to 31 December 2013 (1,764 days) for every negative MNP in the sample (9,026).¹¹ A default is considered declared after all ACSS entries are made for the day.

The simulation results in Table 1 show that the loss allocation would have generated, on average, an AC of \$14.7 million and reached a maximum of \$473.6 million for a single participant.

Table 1 – Summary of default simulations

Variable	Shortfall	AC	Tier 1 ratio	LVTS collateral ratio	Liquidity ratio
Unit	million	million	%	%	%
Maximum	1,995.2	473.6	15.8	36.7	5.2
99.5th per.	1,118.4	180.3	2.3	7.9	0.9
99.0th per.	890.9	142.0	1.6	5.9	0.7
95.0th per.	497.5	64.7	0.6	2.5	0.3
90.0th per.	365.7	39.0	0.3	1.5	0.2
Mean	146.5	14.7	0.1	0.6	0.1
Median	83.4	4.4	0.0	0.2	0.0
10.0th per.	11.0	0.2	0.0	0.0	0.0
5.0th per.	5.0	0.1	0.0	0.0	0.0
1.0th per.	1.0	0.0	0.0	0.0	0.0
0.5th per.	0.5	0.0	0.0	0.0	0.0
Minimum	0.0	0.0	0.0	0.0	0.0

Sources: CPA data and authors' calculations

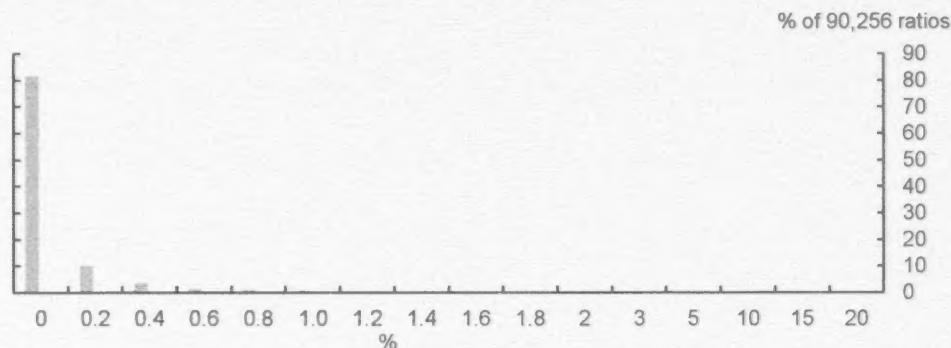
The ACs can also be divided by net Tier 1 capital (Tier 1 capital) to give a better indication of each survivor's capacity to pay.¹²

¹¹ The sample yields a total of 90,256 ACs for those DCs that entered payment items payable by the defaulter.

¹² Net Tier 1 capital is defined as gross Tier 1 capital adjusted to include all Tier 1 regulatory adjustments (see OSFI 2014, chapter 2). For Central 1, we use members' equity in its quarterly/annual reports.

Figure 4 shows a histogram of the ratios of ACs over Tier 1 capital. Relative to Tier 1 capital, 97.8 per cent were below 1 per cent, and 99.3 per cent were below 2 per cent. Over the sample, 93 ACs were higher than or equal to 5 per cent of Tier 1 capital, while 8 ACs were higher than or equal to 10 per cent, with the maximum ratio reaching 15.8 per cent. However, with the vast majority of ratios being extremely low, the results indicate that survivors are able to absorb the potential exposure to a default.

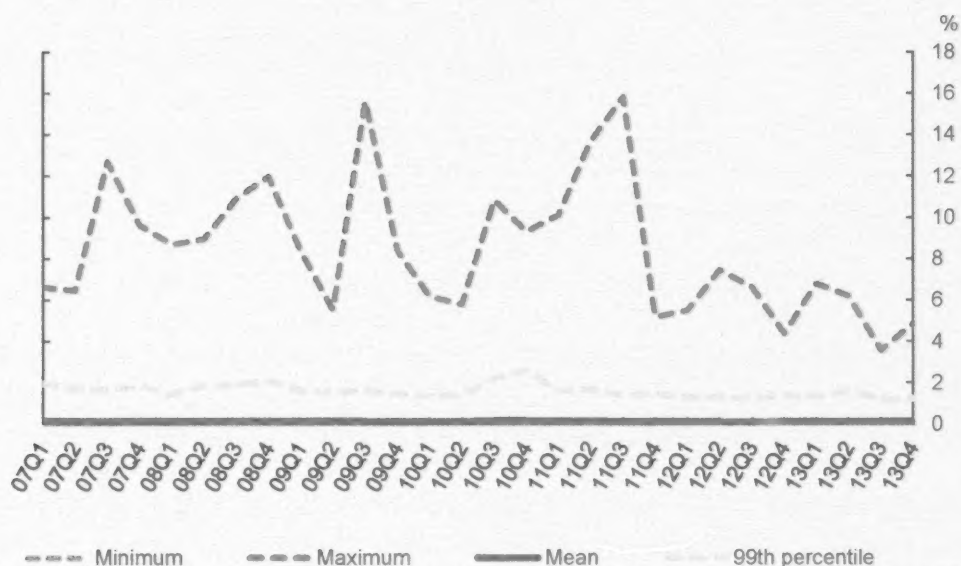
Figure 4: Histogram – ACs as a Percentage of Tier 1 Capital



Source: Authors' calculations

Last observation: 31 December 2013

Figure 5: Quarterly Statistics of ACs as a Percentage of Tier 1 Capital



Source: Authors' calculations

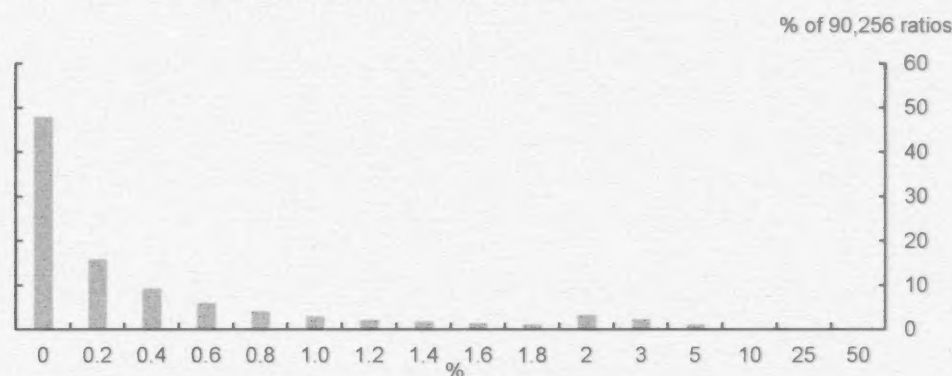
Last observation: 31 December 2013

Figure 5 shows the minimum, mean, 99th percentile and maximum ratios of ACs to Tier 1 capital for each simulated default on a quarterly basis. There appears to be no particular trend except that the maximum ratios per quarter appear lower since 2012.

To give a sense of potential liquidity risk, the ACs can also be examined relative to survivors' holdings of LVTS collateral. This is an appropriate comparison since a survivor would fund the AC through a fully collateralized LVTS payment to the BoC. As expected, ratios of ACs over LVTS collateral are higher than ACs over Tier 1 capital (Table 1).

Relative to collateral allocated to LVTS, 83.5 per cent of the ratios were below 1 per cent, and 93.0 per cent were below 2 per cent (Figure 6). Over the sample, 1,299 ACs were higher than or equal to 5 per cent of LVTS collateral, while 7 ACs were higher than or equal to 25 per cent, with the maximum ratio reaching 36.7 per cent. Once again, however, the vast majority of ratios are very low, which suggests that survivors would be able to pay their AC through an LVTS payment without difficulty.

Figure 6: Histogram – AC as a Percentage of LVTS Collateral

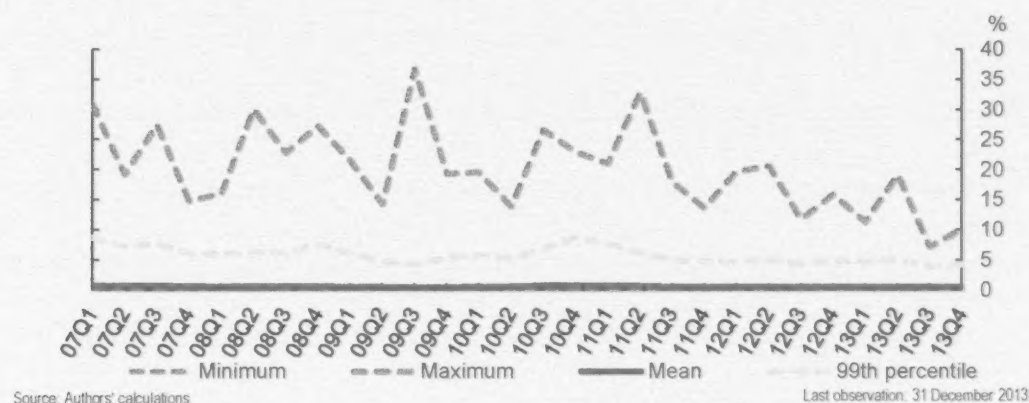


Source: Authors' calculations

Last observation: 31 December 2013

In line with Figure 5, the maximum ratios in Figure 7 appear lower since 2012.

Figure 7: Quarterly Statistics of ACs as a Percentage of LVTS Collateral

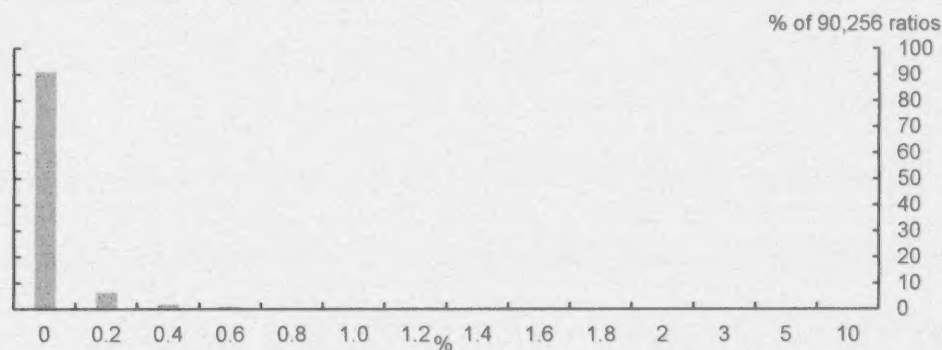


Source: Authors' calculations

Last observation: 31 December 2013

More explicitly, the ACs can also be examined relative to their holdings of liquid assets, which include total cash and cash equivalents, treasury bills and other short-term paper. Again, the ratios show that the ACs do not pose any issues to survivors in terms of the ability to fund the loss-sharing obligations (Figure 8 and Figure 9).

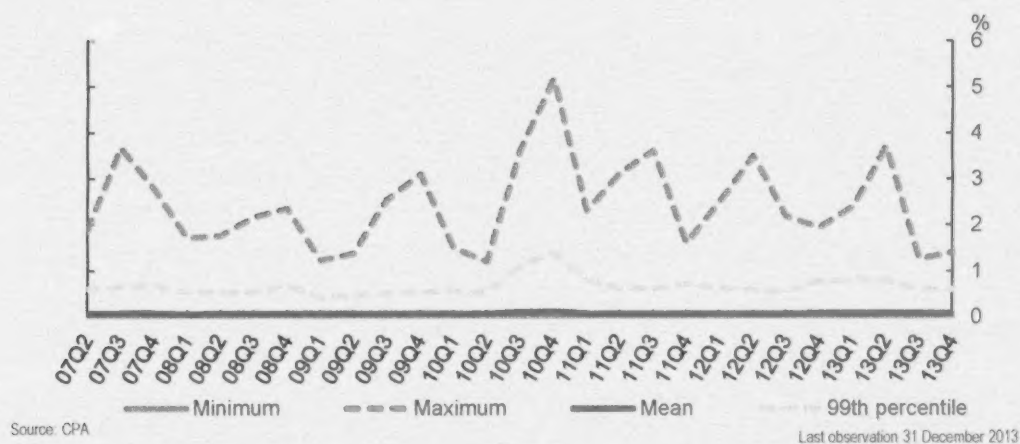
Figure 8: Histogram – ACs as a Percentage of Liquid Assets



Source: Authors' calculations

Last observation: 31 December 2013

Figure 9: ACs as a Percentage of Liquid Assets



Source: CPA

Last observation 31 December 2013

Finally, Table 2 presents results for all combinations of two same-day simulated defaults. Considering all combinations of two defaults is useful since the largest defaults do not always generate the largest losses for all the survivors. The ACs relative to Tier 1 capital, LVTS collateral and liquid assets appear manageable even in the unlikely scenario of two defaults in one day.

Table 2 – Summary of all possible combinations of two same-day simulated defaults

Variable	Shortfall	AC	Tier 1 ratio	LVTS coll. ratio	Liquidity ratio
Unit	million	million	%	%	%
Maximum	2,432.3	767.4	23.0	53.9	11.3
99.5th per.	1,282.6	260.3	3.8	11.8	1.3
99.0th per.	1,112.4	213.7	2.7	9.1	1.0
95.0th per.	709.1	114.6	1.0	4.5	0.5
90.0th per.	559.3	78.4	0.6	3.0	0.3
Mean	269.3	29.9	0.3	1.3	0.1
Median	205.8	13.7	0.1	0.7	0.1
10.0th per.	56.3	1.3	0.0	0.1	0.0
5.0th per.	37.0	0.6	0.0	0.1	0.0
1.0th per.	14.7	0.1	0.0	0.0	0.0
0.5th per.	8.9	0.1	0.0	0.0	0.0
Minimum	1.1	0.0	0.0	0.0	0.0

Sources: CPA data and authors' calculations

In conclusion, a default in the ACSS does not appear to pose systemic risks since the historical data indicate that the loss-sharing arrangements are manageable by the surviving DCs.

5.2 Reverse Stress Testing

The analysis above uses data from a relatively normal period, where payment activity was regular and there were no defaults. In this next section, we examine to what extent the defaulter's shortfall would have to increase to pose a threat to one of the survivors.

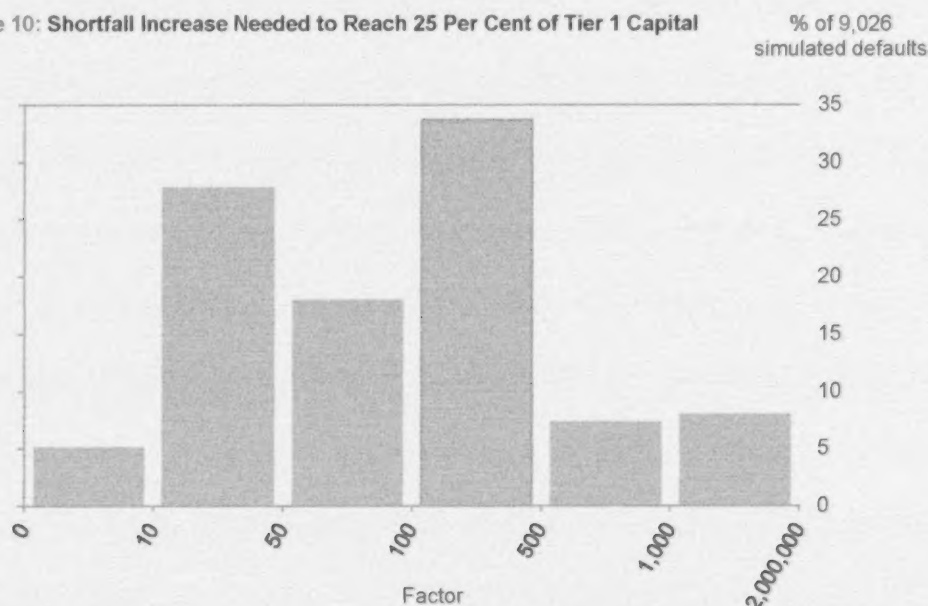
For every simulated default, we calculate the increase in shortfall that would cause the AC of one of the survivors to reach 25 per cent of its Tier 1 capital.¹³ If the shortfall would have to increase multiple times before survivors incur losses representing 25 per cent of their Tier 1 capital, then it would appear unlikely that a default could pose a significant threat.

Figure 10 shows by what factor shortfalls would need to increase so that the AC of one of the survivors represents 25 per cent of its Tier 1 capital. For instance, the first bar shows that 5.1 per cent of the shortfalls would have to increase by less than 10 times. Only 1.6 per cent of the shortfalls require less than a fivefold increase. Out of the 9,026 simulated defaults, only 20 shortfalls would have to increase by less than twofold.

¹³ We assume that Tier 1 capital ratios greater than 25 per cent would represent significant credit risk exposure to a DC. This benchmark is consistent with one of the factors that the Bank considers when determining whether the obligations arising from a clearing and settlement system have the potential to pose systemic risk.

However, four shortfalls require an increase of less than onefold (0.58, 0.60, 0.83 and 0.97). On average, the shortfall would have to increase 813 times.

Figure 10: Shortfall Increase Needed to Reach 25 Per Cent of Tier 1 Capital



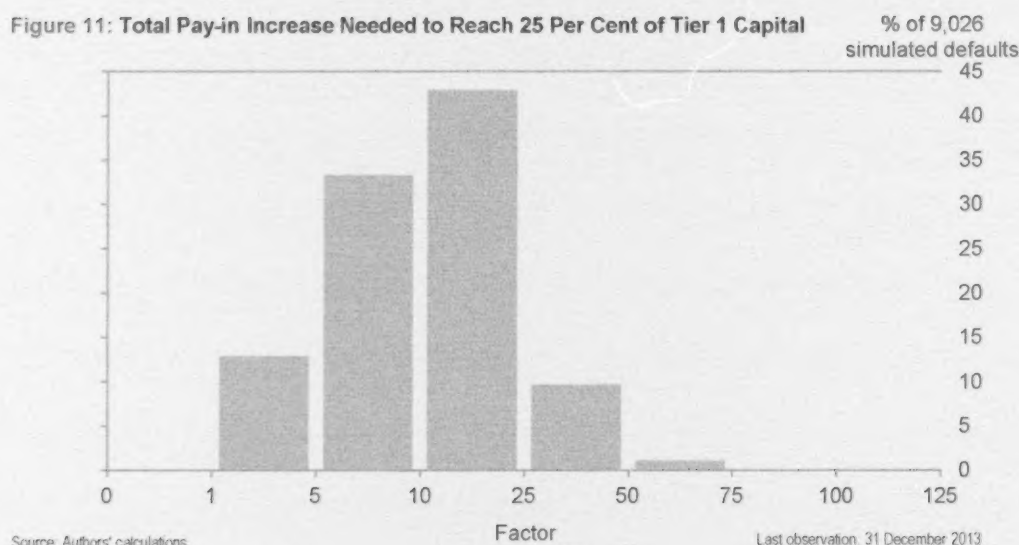
Source: Authors' calculations

Last observation: 31 December 2013

Thus, the shortfall of the simulated defaults would need to increase by extreme amounts for an AC to represent 25 per cent of a survivor's Tier 1 capital.

To determine whether or not the shortfall increases are realistic, we examine the associated increases in total pay-ins/payouts (Figure 11). On average, the daily pay-ins would have to increase by 13.4 times, which is not realistic. Only 0.78 per cent of the pay-in increases are less than twofold. However, six pay-in increases are below onefold (0.46, 0.49, 0.75, 0.80, 0.82 and 0.95). On average, the pay-in would have to increase by 13 times.

Figure 11: Total Pay-in Increase Needed to Reach 25 Per Cent of Tier 1 Capital



6 Risk Mitigation

The ACSS previous default framework with unwinding provisions was considered operationally feasible and perhaps preferable to dealing with unsettled obligations outside of the ACSS legal framework. By eliminating the unwinding provisions, the ACSS simply settles through the loss-allocation arrangements.

This approach minimizes the impact of a default on customers and the potential system-wide knock-on effects on the financial system and the economy. It also simplifies the calculation of the losses by the surviving DCs, which facilitates timelier settlement by the end of day of the default.

Aside from the removal of unwinding provisions, it would be useful to examine how a default would play out in practice. For example, the CPA could conduct a default simulation to test the operational aspects of a default and ensure that all participants understand their roles and responsibilities. The findings would serve as a reference to update and clarify rules and procedures to cope with a default. It would also help to examine the following questions:

- Can ICs bear losses if their CA defaults?
- What is the operational readiness of DCs and ICs in the face of a default?
- Could CPA and ACSS rules, including valid reasons for return, be used by the defaulting DC to contest the ACSS entries?
- Should there be rules that specify when AC payments are due, including ACs resulting from payments exchanged on the day of the default?

A default simulation should also consider the practical implications of payment items exchanged with the defaulting DC *after* it has defaulted. The ACSS rules indicate that all payment items of the defaulting DC that are value dated for an ACSS cycle subsequent to the day of the default shall be purged. Specific reference is made to AFT transactions and EDI payment items that are postdated and reside in "warehouses." A list of purged payment items would then be forwarded to the liquidator or trustee. Each DC is also expected to notify its branches, internal departments and ICs to immediately stop accepting, for clearing purposes, all items drawn on, payable by or payable to, the defaulting DC. However, from a practical perspective, it may be difficult to put an immediate stop on all ACSS payment streams, including ATM and POS debit card transactions used by consumers. On the other hand, the CPA can act quickly to stop the exchange of AFT and EDI items through the CPA Services Network. Such uncertainty may destabilize consumer confidence and force the remaining DCs to absorb losses. How to best deal with this uncertainty and manage potential losses arising from these residual payment items should also be examined.¹⁴

If risk exposures are small, an uncollateralized system with appropriate capital charge requirements on DCs might be adequate. Nevertheless, new features could be added to the ACSS to monitor, cap and/or control the credit and liquidity exposures associated with a default. A variety of options are available, including lowering the current \$25 million cap on paper items and applying a cap to all payment streams. A lower cap on paper items could provide incentives to move from the ACSS to the LVTS where risks can be better managed.

However, other proposals, especially those involving real-time information and risk controls, would require an extensive redesign of the ACSS and the related rules. This may include moving to an intraday settlement model, potentially with multiple clearing intervals; adopting a defaulter-pay model; and introducing collateral requirements.

7 Conclusion

Given the operational and legal hurdles associated with the unwinding provisions, the decision to remove them is appropriate. Our results demonstrate that the credit and liquidity risks could have been managed in the past without the unwinding provisions. Extreme assumptions have to be made to increase the survivor's AC sufficiently to generate significant losses.

Following the removal of the unwinding provisions, the CPA could draw important lessons from a default simulation involving all stakeholders. The CPA could also consider a variety of options for further mitigating credit and liquidity risk exposure. At

¹⁴ These residual payment items probably do not pose a significant threat. Extending the simulated defaults to two consecutive days has not generated ratios much higher than the base case (Table 1): the highest AC relative to Tier 1 capital reached 17.8 per cent; the highest AC relative to LVTS collateral reached 41.7 per cent; and the highest AC relative to liquid assets reached 9.3 per cent.

minimum, CPA should offer ways for DCs and ICs to monitor, cap and/or control their exposures in the system.

This paper examined losses incurred by the default of a DC in the ACSS only. Future extensions of this work could consider the implications for ICs. Research could also be broadened to consider the aggregate credit and liquidity exposures of participants across multiple systems in Canada, including the ACSS, CDCS, CDSX and LVTS.¹⁵

¹⁵ CDSX is Canada's main clearing and settlement system for securities. CDCS is operated by CDCC and offers central counterparty services for exchange-traded and over-the-counter derivatives contracts as well as fixed-income securities.

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